## CLAIMS

1. Method for the detection in a given DNA sequence of DNA mutations, single nucleotide polymorphisms, and insertions and deletions comprising the steps of:
   a) producing replicate(s) with an engineered polymerase of said given DNA sequence with at least 50% of one of the four natural DNA bases exchanged against a not natural base;
   b) using said not natural base to cleave the replicate(s) obtained in step a) and to produce a DNA product presenting sequence-specific fragments;
   c) analyzing said sequence-specific fragments obtained in step b) by mass spectrometry to get sequence-specific fragment patterns; and
   d) using the sequence-specific fragment patterns obtained in step c) to identify sequence changes relative to a reference to said given DNA sequence.

2. Method according to claim 1 wherein the not natural base in step a) is selected from the group consisting of an RNA base (ATP, GTP, CTP, or UTP), a phosphorothioate base, a phosphoroselenoate base, a photochemically cleavage inducible base.

3. Method according to claim 1 and 2 wherein in the replicate more than 70% of one of the four natural DNA bases is exchanged against a not natural base.

4. Method according to claim 3 wherein in the replicate 100% of one of the four natural DNA bases is exchanged against a not natural base.

5. Method according to claim 2 wherein the RNA base is cleaved in step b) by treatment with alkali and incubation at elevated temperature.

6. Method according to claim 2 in which the phosphorothioate or phosphoroselenoate base is cleaved in step b) by condensation of a compound of the nature OH-(CH2)n-I , where n=2-5, and incubation at elevated temperature.

7. Method according to claim 2 in which a photochemically cleavage inducible base is cleaved in step b) by exposure to light.

8. Method according to claim 1 wherein the step a) of producing replicate(s) is carried out with a procedure selected from the group consisting of the polymerase chain reaction (PCR) and the linear DNA copying procedure.

9. Method according to claim 8 wherein the linear copying procedure is a rolling circle replication.

10. Method according to claim 1 comprising further a step a') between step a) and step b), wherein in step a') the replicate(s) is purified, for example on reversed-phase material or with ion exchange resins.

11. Method according to claim 1 comprising further a step b') between step b) and step c), wherein in step b') the sequence-specific fragments are purified, for example on reversed-phase material or with ion exchange resins.

12. Method according to claim 1 wherein the mass spectrometer used for step c) is a MALDI or an ESI mass spectrometer.

13. Kit for the detection in a given DNA sequence of DNA mutations, single nucleotide polymorphisms, and insertions and deletions for implementing a method according to claim 1 comprising:

- An engineered DNA polymerase,
- A set of non-natural bases and dNTPs,
- A buffer.